Amendments to the Claims

Please amend Claims 3, 6, 9-11, 13, 24, 25 and 30. The Claim Listing below will replace all prior versions of the claims in the application:

Claim Listing

1.   (Original) A polypeptide having the ability to bind CEA comprising the amino acid sequence:

Cys-X_4-X_5-X_6-X_7-X_8-X_9-X_{10}-X_{11}-Cys (SEQ ID NO:110),

wherein:

X_4 is Asn, Glu, Asp, or Met;

X_5 is Leu, Phe, Tyr, Trp, Val, Met, Ile, or Asn;

X_6 is Phe, Leu, Asp, Glu, Ala, Ile, Lys, Asn, Ser, Val, Trp, Tyr, Gly, or Thr;

X_7 is Lys, Phe, Asp, Gly, Leu, Asn, Trp, Ala, Gln, or Thr;

X_8 is Asn, Pro, Phe, Gly, Asp, Ala, Ser, Glu, Gln, Trp, His, Arg, Met, Val or Leu;

X_9 is Gln, Lys, Leu, or Gly;

X_{10} is Trp, Ala, or Tyr; and

X_{11} is Phe, Thr, Met, Ser, Ala, Asn, Val, His, Ile, Pro, Trp, Tyr, Gly, Leu, or Glu.

2.   (Original) A polypeptide having the ability to bind CEA comprising the amino acid sequence:

X_1-X_2-X_3-Cys-X_4-X_5-X_6-X_7-X_8-X_9-X_{10}-X_{11}-Cys-X_{12}-X_{13}-X_{14} (SEQ ID NO:111),

wherein:

X_1 is Asp, Asn, Ala, or Ile;

X_2 is Trp;

X_3 is Val, Ile, Met, Tyr, Phe, Pro, or Asp;

X_4 is Asn, Glu, Asp, or Met;

X_5 is Leu, Phe, Tyr, Trp, Val, Met, Ile, or Asn;

X_6 is Phe, Leu, Asp, Glu, Ala, Ile, Lys, Asn, Ser, Val, Trp, Tyr, Gly, or Thr;

X_7 is Lys, Phe, Asp, Gly, Leu, Asn, Trp, Ala, Gln, or Thr;

X_8 is Asn, Pro, Phe, Gly, Asp, Ala, Ser, Glu, Gln, Trp, His, Arg, Met, Val, or Leu;

X_9 is Gln, Lys, Leu, or Gly;

X_{10} is Trp, Ala, or Tyr;

X_{11} is Phe, Thr, Met, Ser, Ala, Asn, Val, His, Ile, Pro, Trp, Tyr, Gly, Leu, or Glu;

X_{12} is Asn, Asp, Glu, Pro, Gln, Ser, Phe, or Val;

X_{13} is Val, Leu, Ile, Pro, Ala, Gln, Ser, Met, Glu, Thr, Lys, Trp, or Arg; and

X_{14} is Leu, Met, Val, Tyr, Ala, Ile, Trp, His, Pro, Gln, Glu, Phe, Lys, Arg or Ser.

3.   (Currently amended) A polypeptide having the ability to bind CEA comprising the amino acid sequence:

Cys-X_4-X_5-X_6-X_7-X_8-X_9-X_{10}-X_{11}-Cys (SEQ ID NO:3),

wherein:

X_4 is Asn, Glu, or Met;

X_5 is Asn, Leu, Met or Phe;

X_6 is Asp, Gly, Ile, Lys, Phe or Thr;

X_7 is Ala, Gln, Gly, Lys or Thr;

X_8 is Arg, Asn, Asp, Glu or Gly;

X_9 is Gln, Gly or Leu;

X_{10} is Ala, Trp or Tyr;

X_{11} is Ala, Gly, His, Phe, Thr or Val[[;]].

4.   (Original) The polypeptide according to Claim 3, wherein:

X_4 is Glu;

X_5 is Asn, Leu, Met or Phe;

X_6 is Asp, Gly, Ile, Lys, Phe or Thr;

X_7 is Lys;

X_8 is Arg, Asn, Asp, Glu or Gly;

X_9 is Gln;

X_{10} is Trp; and

X_{11} is Ala, Gly, His, Phe, Thr or Val.

5. (Original) The polypeptide according to Claim 3, comprising the amino acid sequence:

X_1-X_2-X_3-Cys-X_4-X_5-X_6-X_7-X_8-X_9-X_{10}-X_{11}-Cys-X_{12}-X_{13}-X_{14} (SEQ ID NO:1),

wherein:

X_1 is Asn or Asp;

X_2 is Trp;

X_3 is Asp, Phe or Val;

X_4 is Asn, Glu or Met;

X_5 is Asn, Leu, Met or Phe;

X_6 is Asp, Gly, Ile, Lys, Phe or Thr;

X_7 is Ala, Gln, Gly, Lys or Thr;

X_8 is Arg, Asn, Asp, Glu or Gly;

X_9 is Gln, Gly or Leu;

X_{10} is Ala, Trp or Tyr;

X_{11} is Ala, Gly, His, Phe, Thr or Val;

X_{12} is Asn, Gln, Phe, Ser or Val;

X_{13} is Arg, Leu, Pro or Ser; and

X_{14} is Leu, Ser, Trp or Tyr.

6. (Currently amended) The polypeptide according to Claim 5, ~~having~~ comprising the amino acid sequence:

X_1-Trp-Val-Cys-Glu-X_5-X_6-Lys-X_8-Gln-Trp-X_{11}-Cys-Asn- X_{13}-X_{14} (SEQ ID NO:2), wherein:

X_1 is Asn or Asp;

X_5 is Asn, Leu, Met or Phe;

X_6 is Asp, Gly, Ile, Lys, Phe or Thr;

X_8 is Arg, Asn, Asp, Glu or Gly;

X_{11} is Ala, Gly, His, Phe, Thr or Val;

X_{13} is Arg, Leu, Pro or Ser; and

X_{14} is Leu or Tyr.

7. (Original) The polypeptide according to Claim 5, comprising an amino acid sequence selected from the group consisting of:

Asn-Trp-Val-Cys-Asn-Leu-Phe-Lys-Asn-Gln-Trp-Phe-Cys-Asn-Ser-Tyr (SEQ ID NO:4);

Asp-Trp-Val-Cys-Glu-Asn-Lys-Lys-Asp-Gln-Trp-Thr-Cys-Asn-Leu-Leu (SEQ ID NO:5);

Asn-Trp-Asp-Cys-Met-Phe-Gly-Ala-Glu-Gly-Trp-Ala-Cys-Ser-Pro-Trp (SEQ ID NO:6);

Asp-Trp-Val-Cys-Glu-Lys-Thr-Thr-Gly-Gly-Tyr-Val-Cys-Gln-Pro-Leu (SEQ ID NO:7);

Asn-Trp-Phe-Cys-Glu-Met-Ile-Gly-Arg-Gln-Trp-Gly-Cys-Val-Pro-Ser (SEQ ID NO:8); and

Asp-Trp-Val-Cys-Asn-Phe-Asp-Gln-Gly-Leu-Ala-His-Cys-Phe-Pro-Ser (SEQ ID NO:9).

8. (Original) A polypeptide having the ability to bind CEA comprising the amino acid sequence:

X_1-X_2-X_3-Cys-X_4-X_5-X_6-X_7-X_8-X_9-X_{10}-X_{11}-Cys-X_{12}-X_{13}-X_{14}

(SEQ ID NO:1),

wherein:

X_1 is Asp, Asn, Ala, or Ile;

X_2 is Trp;

X_3 is Val, Ile, Met, Tyr, Phe, Pro, or Asp;

X_4 is Asn, Glu, or Asp;

X_5 is Leu, Phe, Tyr, Trp, Val, Met, Ile, or Asn;

X_6 is Phe, Leu, Asp, Glu, Ala, Ile, Lys, Asn, Ser, Val, Trp, or Tyr;

X_7 is Lys, Phe, Asp, Gly, Leu, Asn, or Trp;

X_8 is Asn, Pro, Phe, Gly, Asp, Ala, Ser, Glu, Gln, or Trp;

X_9 is Gln, or Lys;

X_{10} is Trp;

X_{11} is Phe, Thr, Met, Ser, Ala, Asn, Val, His, Ile, Pro, Trp, or Tyr;

X_{12} is Asn, Asp, Glu, Pro, Gln, or Ser;

X_{13} is Val, Leu, Ile, Pro, Ala, Gln, Ser, Met, Glu, Thr, Lys, or Trp; and

X_{14} is Leu, Met, Val, Tyr, Ala, Ile, Trp, His, Pro, Gln, Glu, Phe, Lys, or Arg.

9. (Currently amended) The polypeptide of ~~claim~~ Claim 1, wherein:

X_4 is Asn, or Glu;

X_5 is Leu, Phe, Tyr, Trp, or Ile;

X_6 is Phe, Leu, Asp, Glu, Ile, Ser, Val, or Gly;

X_7 is Lys;

X_8 is Asn, Pro, Gly, Asp, Ala, Ser, His, Met, Val, or Leu;

X_9 is Gln;

X_{10} is Trp;

X_{11} is Phe, Thr, Ser, Ala, Asn, Val, His, Ile, Trp, Tyr, Leu, or Glu[[;]].

10. (Currently amended) The polypeptide of ~~claim~~ Claim 2, wherein:

X_1 is Asp, or Asn;

X_2 is Trp;

X_3 is Val, Ile, or Met;

X_4 is Asn, or Glu;

X_5 is Leu, Phe, Tyr, Trp, or Ile;

X_6 is Phe, Leu, Asp, Glu, Ile, Ser, Val, or Gly;

X_7 is Lys;

X_8 is Asn, Pro, Gly, Asp, Ala, Ser, His, Met, Val, or Leu;

X_9 is Gln;

X_{10} is Trp;

X_{11} is Phe, Thr, Ser, Ala, Asn, Val, His, Ile, Trp, Leu or Glu;

X_{12} is Asn, or Asp;

X_{13} is Val, Leu, Ile, Pro, Ala, Gln, Ser, or Met[[,]]; and

X_{14} is Leu, Met, Val, Tyr, Trp, His, Gln, Arg, or Ser.

11.   (Currently amended) The polypeptide according to Claim 2, comprising an amino acid sequence ~~selected from the group consisting of SEQ ID NOs:37-109 and 113-151 as depicted in Tables 5, 6, 8, and 9 (SEQ ID NOs:37-109 and 113-151)~~.

12.   (Original) The polypeptide according to Claim 1, 2, 3, 5, 8, 9, or 10, wherein said polypeptide binds to CEA but does not bind to NCA.

13.   (Currently amended) The polypeptide according to Claim 1, 2, 3, 5, 8, 9, or 10, wherein said polypeptide has a K_d for CEA which is less than 7 µM.

14.   (Original) A method of detecting CEA in a subject comprising the steps of:

        a) detectably labeling a polypeptide according to any one of Claims 1-11;

        b) administering to said subject the labeled polypeptide; and, thereafter,

        c) detecting the labeled polypeptide in the subject.

15.   (Original) The method according to Claim 14, wherein said polypeptide is labeled with a radioactive compound.

16.   (Original) The method according to Claim 15, wherein said radioactive compound includes indium.

17.   (Original) The method according to Claim 15, wherein said radioactive compound includes technetium.

18.   (Original) The method according to Claim 14, wherein said detecting step is indicative of colon cancer, breast cancer, lung cancer, cervical cancer, ovarian cancer, stomach cancer, bladder cancer, pancreatic cancer or esophageal cancer.

19.   (Original) A method of treating a CEA associated disease comprising the step of:

administering to a subject in need of treatment for such a disease a composition comprising a polypeptide according to any one of Claims 1-11 conjugated with a therapeutic agent effective for treating said disease.

20. (Original) The method according to Claim 19, wherein said CEA associated disease is colon cancer, breast cancer, lung cancer, cervical cancer, ovarian cancer, stomach cancer, bladder cancer, pancreatic cancer or esophageal cancer.

21. (Original) The method according to Claim 19, wherein said therapeutic agent is a radioactive agent.

22. (Original) The method according to Claim 19, wherein said therapeutic agent is a chemotherapeutic agent.

23. (Original) The method according to Claim 19, wherein said therapeutic agent is a toxin or enzyme.

24. (Currently amended) A recombinant bacteriophage expressing exogenous DNA encoding a CEA binding polypeptide having an amino acid sequence comprising:

$Cys-X_4-X_5-X_6-X_7-X_8-X_9-X_{10}-X_{11}-Cys$ (SEQ ID NO:110),

wherein:

X_4 is Asn, Glu, Asp, or Met;

X_5 is Leu, Phe, Tyr, Trp, Val, Met, Ile, or Asn;

X_6 is Phe, Leu, Asp, Glu, Ala, Ile, Lys, Asn, Ser, Val, Trp, Tyr, Gly, or Thr;

X_7 is Lys, Phe, Asp, Gly, Leu, Asn, Trp, Ala, Gln, or Thr;

X_8 is Asn, Pro, Phe, Gly, Asp, Ala, Ser, Glu, Gln, Trp, His, Arg, Met, Val, or Leu;

X_9 is Gln, Lys, Leu, or Gly;

X_{10} is Trp, Ala, or Tyr; and

X_{11} is Phe, Thr, Met, Ser, Ala, Asn, Val, His, Ile, Pro, Trp, Tyr, Gly, Leu, or Glu[[.]].

and wherein said binding polypeptide is displayed on the surface of said bacteriophage.

25. (Currently amended) A recombinant bacteriophage expressing exogenous DNA encoding a CEA binding polypeptide having an amino acid sequence comprising:

X_1-X_2-X_3-Cys-X_4-X_5-X_6-X_7-X_8-X_9-X_{10}-X_{11}-Cys-X_{12}-X_{13}-X_{14} (SEQ ID NO:111),

wherein:

X_1 is Asp, Asn, Ala, or Ile;

X_2 is Trp;

X_3 is Val, Ile, Met, Tyr, Phe, Pro, or Asp;

X_4 is Asn, Glu, Asp, or Met;

X_5 is Leu, Phe, Tyr, Trp, Val, Met, Ile, or Asn;

X_6 is Phe, Leu, Asp, Glu, Ala, Ile, Lys, Asn, Ser, Val, Trp, Tyr, Gly, or Thr;

X_7 is Lys, Phe, Asp, Gly, Leu, Asn, Trp, Ala, Gln, or Thr;

X_8 is Asn, Pro, Phe, Gly, Asp, Ala, Ser, Glu, Gln, Trp, His, Arg, Met, Val, or Leu;

X_9 is Gln, Lys, Leu, or Gly;

X_{10} is Trp, Ala, or Tyr;

X_{11} is Phe, Thr, Met, Ser, Ala, Asn, Val, His, Ile, Pro, Trp, Tyr, Gly, Leu, or Glu;

X_{12} is Asn, Asp, Glu, Pro, Gln, Ser, Phe, or Val;

X_{13} is Val, Leu, Ile, Pro, Ala, Gln, Ser, Met, Glu, Thr, Lys, Trp, or Arg; and

X_{14} is Leu, Met, Val, Tyr, Ala, Ile, Trp, His, Pro, Gln, Glu, Phe, Lys, Arg, or Ser[[.]].

and wherein said binding polypeptide is displayed on the surface of said bacteriophage.

26. (Original) A recombinant bacteriophage expressing exogenous DNA encoding a CEA binding polypeptide having an amino acid sequence comprising:

X_1-X_2-X_3-Cys-X_4-X_5-X_6-X_7-X_8-X_9-X_{10}-X_{11}-Cys-X_{12}-X_{13}-X_{14}

(SEQ ID NO:1),

wherein:

X_1 is Asp, Asn, Ala, or Ile;

X_2 is Trp;

X_3 is Val, Ile, Met, Tyr, Phe, Pro, or Asp;

X_4 is Asn, Glu, or Asp;

X_5 is Leu, Phe, Tyr, Trp, Val, Met, Ile, or Asn;

X_6 is Phe, Leu, Asp, Glu, Ala, Ile, Lys, Asn, Ser, Val, Trp, or Tyr;

X_7 is Lys, Phe, Asp, Gly, Leu, Asn, or Trp;

X_8 is Asn, Pro, Phe, Gly, Asp, Ala, Ser, Glu, Gln, or Trp;

X_9 is Gln, or Lys;

X_{10} is Trp;

X_{11} is Phe, Thr, Met, Ser, Ala, Asn, Val, His, Ile, Pro, Trp, or Tyr;

X_{12} is Asn, Asp, Glu, Pro, Gln, or Ser;

X_{13} is Val, Leu, Ile, Pro, Ala, Gln, Ser, Met, Glu, Thr, Lys, or Trp; and

X_{14} is Leu, Met, Val, Tyr, Ala, Ile, Trp, His, Pro, Gln, Glu, Phe, Lys, or Arg

and wherein said binding polypeptide is displayed on the surface of said bacteriophage.

27.   (Original) A recombinant bacteriophage expressing exogenous DNA encoding a CEA binding polypeptide having an amino acid sequence comprising:

$Cys-X_4-X_5-X_6-X_7-X_8-X_9-X_{10}-X_{11}-Cys$ (SEQ ID NO:110),

wherein:

X_4 is Asn, or Glu;

X_5 is Leu, Phe, Tyr, Trp, or Ile;

X_6 is Phe, Leu, Asp, Glu, Ile, Ser, Val, or Gly;

X_7 is Lys;

X_8 is Asn, Pro, Gly, Asp, Ala, Ser, His, Met, Val, or Leu;

X_9 is Gln;

X_{10} is Trp;

X_{11} is Phe, Thr, Ser, Ala, Asn, Val, His, Ile, Trp, Tyr, Leu, or Glu;

and wherein said binding polypeptide is displayed on the surface of said bacteriophage.

28.   (Original) A recombinant bacteriophage expressing exogenous DNA encoding a CEA binding polypeptide having an amino acid sequence comprising:

X_1-X_2-X_3-Cys-X_4-X_5-X_6-X_7-X_8-X_9-X_{10}-X_{11}-Cys-X_{12}-X_{13}-X_{14} (SEQ ID NO:111),

wherein:

X_1 is Asp, or Asn;

X_2 is Trp;

X_3 is Val, Ile, or Met;

X_4 is Asn, or Glu;

X_5 is Leu, Phe, Tyr, Trp, or Ile;

X_6 is Phe, Leu, Asp, Glu, Ile, Ser, Val, or Gly;

X_7 is Lys;

X_8 is Asn, Pro, Gly, Asp, Ala, Ser, His, Met, Val, or Leu;

X_9 is Gln;

X_{10} is Trp;

X_{11} is Phe, Thr, Ser, Ala, Asn, Val, His, Ile, Trp, Tyr, Leu or Glu;

X_{12} is Asn, or Asp;

X_{13} is Val, Leu, Ile, Pro, Ala, Gln, Ser, or Met,; and

X_{14} is Leu, Met, Val, Tyr, Trp, His, Gln, Arg, or Ser.

and wherein said binding polypeptide is displayed on the surface of said bacteriophage.

29.   (Original) The recombinant bacteriophage according to Claim 26, expressing exogenous DNA encoding an amino acid sequence selected from the group consisting of:

Asn-Trp-Val-Cys-Asn-Leu-Phe-Lys-Asn-Gln-Trp-Phe-Cys-Asn-Ser-Tyr (SEQ ID NO:4);

Asp-Trp-Val-Cys-Glu-Asn-Lys-Lys-Asp-Gln-Trp-Thr-Cys-Asn-Leu-Leu (SEQ ID NO:5);

Asn-Trp-Asp-Cys-Met-Phe-Gly-Ala-Glu-Gly-Trp-Ala-Cys-Ser-Pro-Trp (SEQ ID NO:6);

Asp-Trp-Val-Cys-Glu-Lys-Thr-Thr-Gly-Gly-Tyr-Val-Cys-Gln-Pro-Leu (SEQ ID NO:7);

Asn-Trp-Phe-Cys-Glu-Met-Ile-Gly-Arg-Gln-Trp-Gly-Cys-Val-Pro-Ser (SEQ ID NO:8); and

Asp-Trp-Val-Cys-Asn-Phe-Asp-Gln-Gly-Leu-Ala-His-Cys-Phe-Pro-Ser
(SEQ ID NO:9).

30.   (Currently amended) The recombinant bacteriophage according to Claim 25, expressing
exogenous DNA encoding an amino acid sequence selected from the group <u>consisting of</u>
<u>SEQ ID NOs:37-109 and 113-151</u> ~~of sequences depicted in Tables 5, 6, 8, and 9 (SEQ ID~~
~~NOs:37-109 and 113-151)~~.